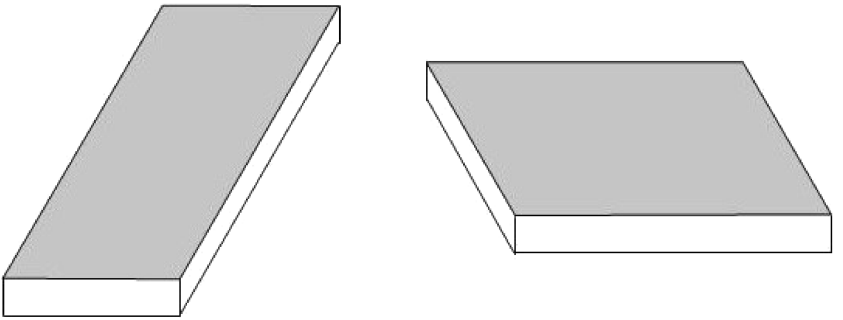

Figure 4.1. Are the shaded surfaces identical in shape? Adapted from Roger N. Shepard (1990), *Mind Sights*. New York: Freeman, p. 48.

(Bechtel, 2001) but most of us are blissfully unaware of these. Fortunately, our visual system is very well adapted to the environment in which we live; accordingly, illusions as dramatic as the one generated by Figure 4.1 are rare.

Like our visual system, the instruments used by scientists procure information by performing complex operations on phenomena of interest. They are thus prone to generating artifacts. Because, unlike the visual system, these instruments have not been honed by natural selection over a long phylogenetic history, the risk of artifact is acute. As a result, evidence advanced using new instruments and new techniques for using existing instruments[1] often is vigorously contested. Competing scientists question whether the evidence really reflects the phenomena of nature. The controversies surrounding new instruments and techniques are often the most bitter in science. Eventually they dissipate. The instruments and techniques for using them are refined so that the community of scientists agrees they are producing reliable information about the structure of the phenomena. Scientists publish manuals of standardized procedures and the community of investigators employs common tools for procuring evidence.[2] The instruments and techniques for using them become, in the language of Latour (1987), black boxes.

[1] We typically are unaware not only that our senses are instruments but that there are procedures for using them. There are exceptional contexts in which we must train ourselves in the procedures for seeing particular objects – for example, to see an afterimage by first staring at a colored patch and then shifting to looking at a white wall. But with scientific instruments, the techniques for using them are often as important as the instrument itself in determining what evidence is produced. To keep this in focus, I usually will distinguish between instruments and the techniques for their use.

[2] In biochemistry, for example, volumes in the series *Methods in Enzymology* began to be published in 1955 under the editorship of Sidney Colowick and Nathan Kaplan. In 1964 an annual publication, *Methods in Cell Physiology*, began to appear under the editorship of David M. Prescott. In 1973 the title changed to *Methods in Cell Biology* and has subsequently expanded to include multiple volumes per year.